Roman CPP Data Reduction & Simulations Working Group

AAS Jan. 14

Presented by:

Maxwell Millar-Blanchaer

What does the DR&S Working Group Do?

- Delivering of the official DRP

- Expanding the existing simulation tools

- Intimate interactions with the Coronagraph Technology Center, the Science Support Center and the PS

DR&S Working Group Co-Leads

DRP Product Delivery Lead

Jason Wang
Northwestern

Max Millar-Blanchaer
UC Santa Barbara

Marie Ygouf
JPL

Who is the DR&S Working Group?

Alexandra Greenbaum
Tyler Robinson
Karl Stapelfeldt
John Krist
Vanessa Bailey
Rob Zellem
Neil Zimmerman
Taichi Uyama
Hanying Zhou
Sergi Hildebrandt
Sarah Blunt
Markus Feldt
Bruce Macintosh
Ell Bogat
Jessica Gersh-Range
Bertrand Mennesson
Yui Kawashima
Hajime Kawahara

Satoshi Itoh
Aoi Takahashi
Frans Snik
David Doelman
Óscar Carrión-González
Axel Potier
Elodie Choquet
Jason Wang
Ramya M Anche
tyler groff
Jun Nishikawa
Shota Miyazaki
Johan Mazoyer
Hibiki Yama
Wolfgang Brandner
Matthias Samland
Juergen Schreiber
Motohide Tamura

John Debes
Remi soummer
Naoshi Murakami
Mark Marley
N. Jeremy Kasdin
Kenta Yoneta
Lisa Altinier
Robert De Rosa
Oliver Krause
Arthur Vigan
Sarah Moran
Max Millar-Blanchaer
Marie Ygouf
Tsutsumi Nagai
Benjamin Charnay
Jorge Llop-Sayson
Julien Girard
Gael Chauvin

John Livingston
Schuyler Wolff
Remi Soummer
Malachi Noel
Justin Hom
Dan Sirbu
Samantha Hasler
Kevin Ludwick
Cynthia Wong
Zhexing Li
Emmanuel Joliet
Amanda Chavez
Beth Biller
Ramya Anche
Alexis Lau
Toshiyuki Mizuki
Michele Woodland
Marah Brinjikji

Zarah L Brown
Masayuki Kuzuhara
Pengyu Liu
Catherine Clark
Julia Milton
Koji Kawabata
Bijan Nemati
Guillermo Gonzalez
Alexis Bidot
Eduardo Bendek
Macarena Constanza
Vega Pallauta
Ben Sutlieff
Jingwen Zhang

DRP Development Team

Ell Bogat
U of Maryland, NASA GSFC

Sergi Hildebrandt
JPL

Amanda Chavez
Northwestern

Matthias Samland
MPIA

Kevin Ludwick
University of Alabama

Julia Milton
JPL

Lisa Altinier
LAM

Ramya Anche
University of Arizona

Taichi Uyama
Cal State Northridge

Juergen Schreiber
MPIA

4

What is CorgiDRP?

- The official data reduction pipeline for data from the Coronagraph Instrument

- Development Philosophies:

  - Open Source (from the start!)

  - User Friendly

  - Easy to develop for astronomers

  - Flexible/Modular (easy to run one step at a time)

  - Transparent data manipulation (the data is easily accessible at each step)

  - Pip installable

Who is the DRP for?

CTC Ground Software	Science Support Center	The Community
The DRP needs to produce data for wavefront sensing: • The GITL loop uses Level 2 Data Products from the DRP	The DRP needs to produce data for archiving • Level 1 Data Products will be archived immediately • Level 2 Data Products will be processed by the DRP for public archiving	The DRP needs to produce data for independent processing: • Users will be able to process their own data in their own way

What does the DRP do?

L1 -> L2a	L2a -> L2b	L2b -> L3	L3 -> L4	L4 -> TDA
• Separate image from prescan/overscan • Subtract bias • Mask cosmic rays • Correct non-linearity	• Convert DN to electrons • Divide EM gain • Apply dark & flat field • Apply master bad pixel (BP) map • Desmear and CTI Correction	• Normalize by exposure time • Construct World Coordinate System transformation & distortion correction	• Correct distortion/BP • Measure target star position • PSF subtraction • Combine images in observation sequence	• Calculate target star apparent mag. • Flux ratio noise vs. separation • Companion apparent mag, flux ratio, SNR

DRP Architecture

- Basic Principle: Dataset In -> Dataset Out
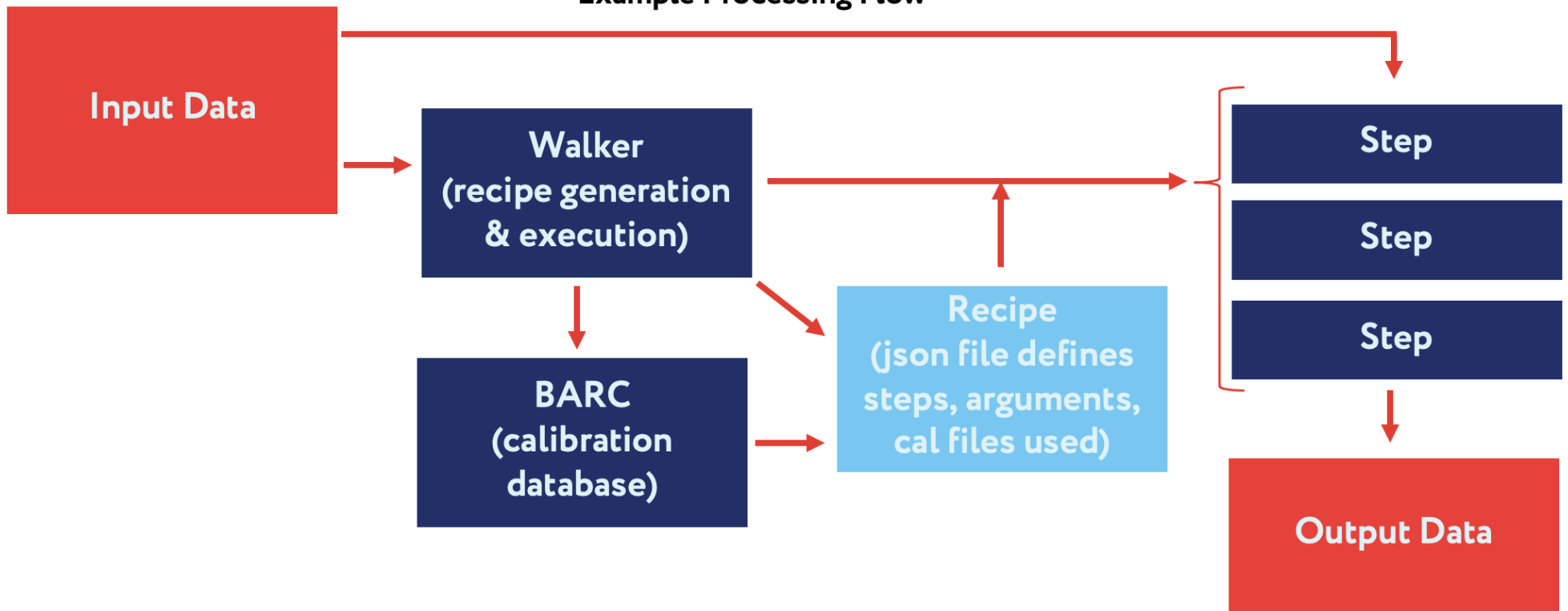- Datasets are essentially lists of Astropy HDUs
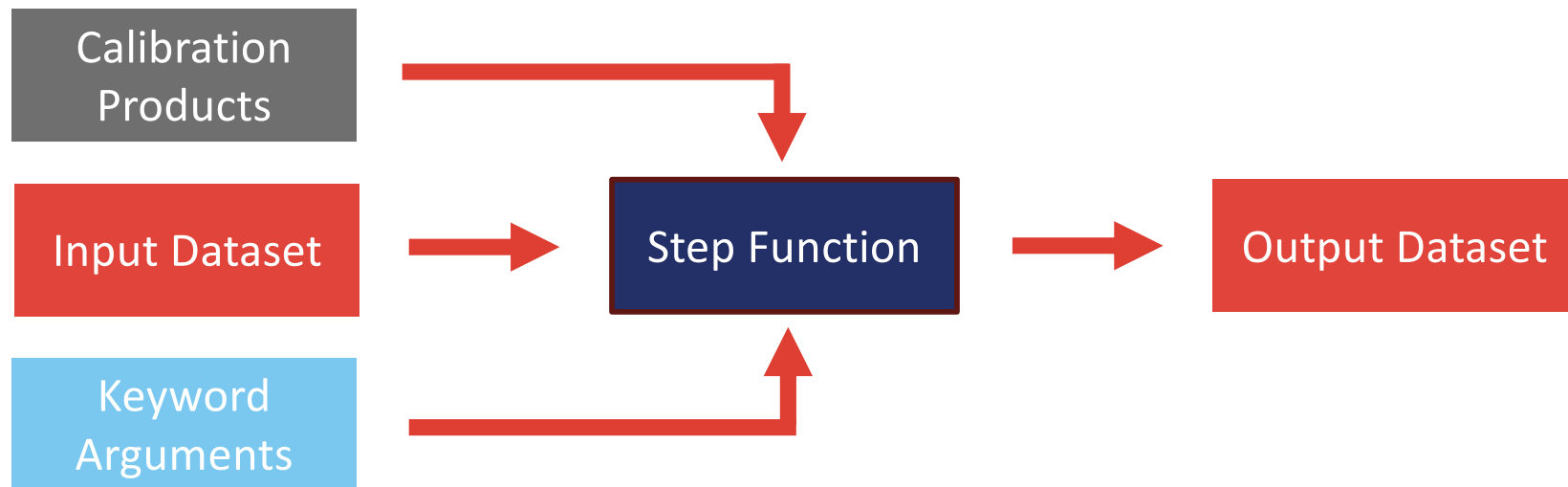
DRP Architecture

Example Processing Flow

Input Data

Walker
(recipe generation
& execution)

BARC
(calibration
database)

Recipe
(json file defines
steps, arguments,
cal files used)

Step

Step

Step

Output Data

*Heritage from the GPI DRP and KPIC DRP

DRP Year 1 In Review

- Kick-off at Face to Face meeting in Feb 2024

- Established Main DRP Architecture

- Ported Engineering Code to new Architecture

- Started to define Data Format, Header Keywords

  - Working with many other part of the team

- **Successfully delivered Version 1 of the pipeline (R3.0.1)**

  - Passed All Acceptance Tests as of Dec. 22, 2024
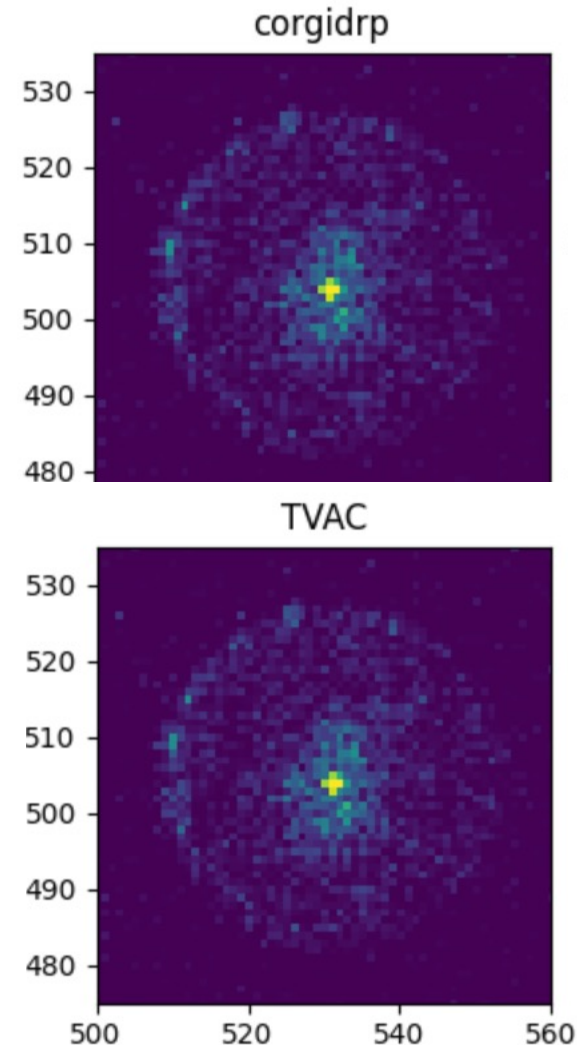
DRP Current Status

- Total Commits: 1198
- Total Lines of code: 24,294
  - (Includes heritage from the Engineering code)
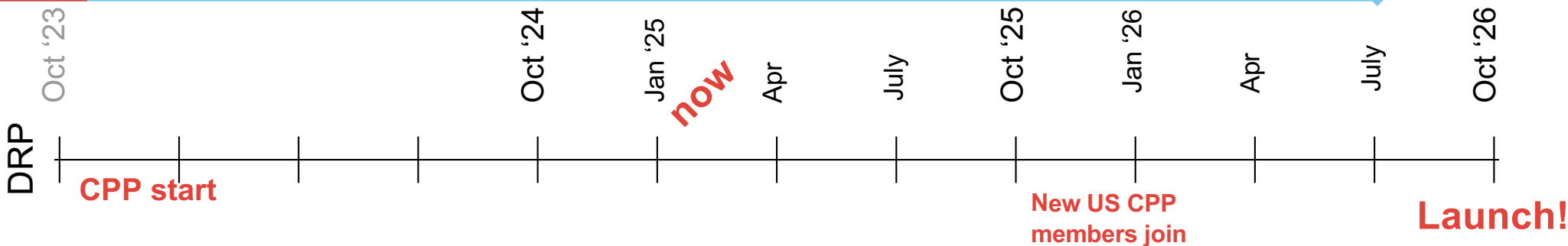- Total number of Contributors: 13
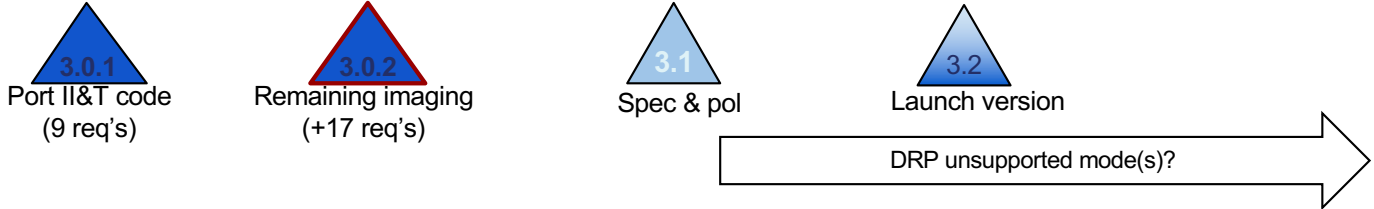
Expanding Simulator Suite

- Goals:
  - Produce L1 data products
  - Simulate **Everything** to help with observation planning and DRP validation:
    - Include optical simulations from `cgisim`
    - Include detector simulations from `emccd_detect`
  - Easy to use for new users
  - Powerful for super-users
- Status:
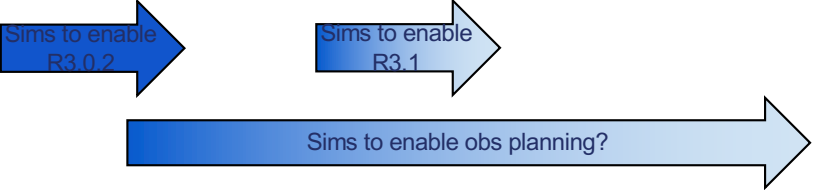 - Architecture Established
  - Code Under Development

CorGI sim

DRP Schedule

Oct '23

Oct '24 **Jan '25** **now** **Apr** **July** **Oct '25** **Jan '26** **Apr** **July** **Oct '26**

DRP

CPP start

New US CPP members join

Launch!

DRP Deliveries

3.0.1
Port II&T code
(9 req's)

3.0.2
Remaining imaging
(+17 req's)

3.1
Spec & pol

3.2
Launch version

DRP unsupported mode(s)?

Simulations Phasing

Sims to enable
R3.0.2

Sims to enable
R3.1

Sims to enable obs planning?

Coming In the Next Year

- DRP Release R3.0.2 – Complete Main Functionality

- DRP Release R3.1 – Spectroscopy and Polarimetry Modes

- Complete Simulator Architecture and Start Simulation Suite

- **Want to get involved? Best way is to apply to th Coronagraph Community Participation Program**
  - NOIs Due Jan 17!